

What is claimed is:

1. A voltage generating circuit having a boosting circuit for generating a higher voltage than a power source voltage, and a reference voltage generating circuit for generating a reference voltage, a desired voltage being generated on the basis of the reference voltage, comprising:

a voltage variation detecting circuit having a first input connected to the output of the boosting circuit, a second input connected to the power source, and a third input connected to the ground, reference current equivalent to current occurring due to the potential difference between the first input and the second input being made to flow into the third input to thereby generate a control voltage at a first output;

a differential amplifier circuit for comparing the control voltage and the reference voltage; and

a clamp circuit for extracting current from the output of the boosting circuit in accordance with the output of the differential amplifier circuit to control the output voltage of the boosting circuit.

2. A voltage generating circuit having a boosting circuit for generating a higher voltage than a power source voltage, and a reference voltage generating circuit for generating a reference voltage, a desired voltage being generated on the basis of the reference voltage, comprising:

a reference voltage switching circuit for carrying out a switching operation between the power source voltage and the ground voltage in accordance with a reference voltage switching signal;

a voltage variation detecting circuit having a first input connected to the output of the boosting circuit, a second input connected to the output of the reference voltage switching circuit, and a third input connected to the ground, reference current equivalent to current occurring due to the potential difference between the first input and the second input being made to flow into the third input to thereby generate a control voltage at a first output;

a differential amplifier circuit for comparing the control voltage and the reference voltage; and

a clamp circuit for extracting current from the output of the boosting circuit in accordance with the output of the differential amplifier circuit to control the output voltage of the boosting circuit.

3. voltage generating circuit having a boosting circuit for generating a higher voltage than a power source voltage, and a reference voltage generating circuit for generating a reference voltage, a desired voltage being generated on the basis of the reference voltage, comprising:

an external voltage applying circuit for carrying out a

switching operation between an external applied voltage and the power source voltage and outputting the switched one;

a voltage variation detecting circuit having a first input connected to the output of the boosting circuit, a second input connected to the output of the reference voltage switching circuit, and a third input connected to the ground, reference current equivalent to current occurring due to the potential difference between the first input and the second input being made to flow into the third input to thereby generate a control voltage at a first output;

a differential amplifier circuit for comparing the control voltage and the reference voltage; and

a clamp circuit for extracting current from the output of the boosting circuit in accordance with the output of the differential amplifier circuit to control the output voltage of the boosting circuit.

4. A voltage generating circuit having a boosting circuit for generating a higher voltage than a power source voltage, and a reference voltage generating circuit for generating a reference voltage, a desired voltage being generated on the basis of the reference voltage, characterized by comprising:

a voltage variation detecting circuit having a first input connected to the output of the boosting circuit, a second input connected to the power source, and a third input connected to

the ground, reference current equivalent to current occurring due to the potential difference between the first input and the second input being made to flow into the third input to thereby generate a control voltage at a first output;

first switching means for receiving a set voltage switching signal, carrying out a switching operation between the first input and the ground voltage and outputting the switched one;

second switching means connected between two terminals of the first input and the second input and switching the potential difference between the first input and the second input in accordance with the output voltage of the first switching means;

a differential amplifier circuit for comparing the control voltage and the reference voltage; and

a clamp circuit for extracting current from the output of the boosting circuit in accordance with the output of the differential amplifier circuit to control the output voltage of the boosting circuit.

5. A voltage generating circuit having a boosting circuit for generating a higher voltage than a power source voltage, and a reference voltage generating circuit for generating a reference voltage, a desired voltage being generated on the basis of the reference voltage, comprising:

a voltage variation detecting circuit having a first input connected to the output of the boosting circuit, a second input

connected to the power source, and a third input connected to the ground, reference current being generated by a voltage applied to a fourth input so as to keep a constant current ratio to current occurring due to the potential difference between the first input and the second input, and being made to flow into the third input to thereby generate a control voltage at a first output;

first switching means for receiving a set voltage switching signal, carrying out a switching operation between the first input and the ground voltage and outputting the switched one;

second switching means connected between two terminals of the first input and the second input and switching the potential difference between the first input and the second input in accordance with the output voltage of the first switching means;

third switching means connected to the output of the first switching means, switching any voltage between the first input and the second input or the ground voltage in accordance with the set voltage switching signal and applying the switching result to the fourth input;

a differential amplifier circuit for comparing the control voltage and the reference voltage; and

a clamp circuit for extracting current from the output of the boosting circuit in accordance with the output of the differential amplifier circuit to control the output voltage of the boosting circuit.

6. The voltage generating circuit according to any one of

claims 1 to 5, wherein said clamp circuit has a first conduction type transistor having a source connected to the output of the boosting circuit, a gate connected to the output of the differential amplifier circuit and a drain connected to the power source or the ground, and the differential amplifier circuit is supplied with the output voltage of the boosting circuit, compares the control voltage and the reference voltage and carries out differential amplification with the output voltage of the boosting circuit.

7. The voltage generating circuit according to any one of claims 1 to 5, wherein the clamp circuit comprises a first conduction type first transistor having a source connected to the output of the boosting circuit, and a gate and a drain that are connected to a first terminal, a first conduction type second transistor having a source connected to the output of the boosting circuit, a gate connected to the first terminal and a drain connected to the power source or the ground, and a second conduction type transistor connected between the first terminal and the ground and having a gate connected to the output of the differential amplifier circuit, and said differential amplifier circuit is supplied with the output voltage of the boosting circuit, compares the control voltage and the reference voltage and carries out differential amplification with the power source voltage.

8. A voltage generating circuit having a boosting circuit

for generating a voltage higher than a power source voltage and a reference voltage generating circuit for generating a reference voltage, a desired voltage being generated on the basis of the reference voltage, characterized by comprising:

a level shift circuit for receiving an output voltage of the boosting circuit to level-shift the voltage and outputting the voltage thus level-shifted;

a voltage variation detecting circuit having a first input connected to the output of the level shift circuit, a second input connected to the power source and a third input connected to the ground, reference current equivalent to current occurring due to the potential difference between the first input and the second input being made to flow into the third input to generate a control voltage at a first output; and

a differential amplifier circuit for comparing the control voltage and the reference voltage to control the level shift circuit, and outputting a desired voltage as the output of the level shift circuit.

9. The voltage generating circuit according to claim 8, further comprising:

first switching means for receiving a set voltage switching signal, carrying out a switching operation between the first input and the ground voltage and outputting the switched one; and

second switching means connected between the first input and the second input for switching the potential difference between the first input and the second input in accordance with the output voltage of the first switching means.

10. The voltage generating circuit according to claim 8, further comprising:

a voltage variation detecting circuit having a first input connected to the output of the level shift circuit, a second input connected to the power source, a third input connected to the ground and a fourth input, reference current being generated by a voltage applied to the fourth input so as to keep a constant current ratio to current occurring due to the potential difference between the first input and the second input, and the reference current being made to flow into the third input to generate a control voltage at a first output;

first switching means for receiving a set voltage switching signal, carrying out a switching operation between the first input and the ground voltage and outputting the switched one;

second switching means connected between the first input and the second input for switching the potential difference between the first input and the second input in accordance with the output voltage of the first switching means; and

third switching means connected to the output of the first switching means for switching to any voltage between the first



input and the second input or the ground voltage and applying the switched voltage to the fourth input.

11. The voltage generating circuit according to any one of claims 8 to 10, wherein the level shift has a first conduction type transistor having a source connected to the output of the boosting circuit, a gate connected to the output of the differential amplifier circuit and a drain connected to the output of the level shift circuit, and the differential amplifier circuit is supplied with an output voltage of the boosting circuit, comparing the control voltage and the reference voltage and carrying out differential amplification on the basis of the output voltage of the boosting circuit.

12. The voltage generating circuit according to any one of claims 8 to 10, wherein the level shift circuit comprises:

a first conduction type first transistor having a source connected to the output of the boosting circuit and a gate and a drain that are connected to a first terminal; and

a first conduction type second transistor having a source connected to the output of the boosting circuit, a gate connected to the first terminal and a drain connected to the output of the level shift circuit; and a second conduction type transistor connected between the first terminal and having a gate connected to the output of the differential amplifier circuit, and the

differential amplifier circuit is supplied with the power source voltage, comparing the control voltage and the reference voltage and carrying out differential the differential amplification by the power source voltage.

13. The voltage generating circuit according to any one of claims 4, 5, 11 and 12, further comprising

a reference voltage switching circuit for carrying out a switching operation between the power source voltage and the ground voltage in accordance with a reference voltage switching signal,

wherein the second input is connected to the output of the reference voltage switching circuit.

14. The voltage generating circuit according to any one of claims 4, 5, 11 and 12, further comprising:

a reference voltage generating circuit for generating a reference voltage on the basis of the power source voltage, and a reference voltage switching circuit for carrying out a switching operation between the power source voltage or the ground voltage and the reference voltage in accordance with a reference voltage switching signal,

wherein the second input is connected to the output of the reference voltage switching circuit.

15. The voltage generating circuit according to any one of claims 1, 4, 5, 11 and 12, further comprising:

a reference voltage generating circuit for generating a reference voltage from the power source voltage, and

a reference voltage switching circuit for selecting any one of the power source voltage, the ground voltage and the reference voltage in accordance with a reference voltage switching signal,

wherein the second input is connected to the output of the reference voltage switching circuit.

16. The voltage generating circuit according to any one of claims 4, 5, 11 and 12, further comprising:

an external voltage applying circuit for carrying out a switching operation between an external voltage and the power source voltage in accordance with an external voltage applying signal and outputting the switched one,

wherein the second input is connected to the output of the external voltage applying circuit.

17. The voltage generating circuit according to any one of claims 1, 4, 5, 11 and 12, further comprising an external voltage applying circuit for carrying out a switching operation between an external voltage and the ground voltage in accordance with an external voltage applying signal and outputting the switched

one, wherein the second input is connected to the output of the external voltage applying circuit.

17. The voltage generating circuit according to any one of claims 1, 4, 5, 11 and 12, further comprising:

a reference voltage generating circuit for generating a reference voltage from the power source voltage, and

an external voltage applying circuit for carrying out a switching operation between an external applied voltage and the reference voltage in accordance with an external voltage applying signal and outputting the switched one,

wherein the second input is connected to the output of the external voltage applying circuit.

18. The voltage generating circuit according to any one of claims 2, 13, 14 and 15, further comprising:

an external voltage applying circuit for receiving an external applied voltage and the output voltage of the reference voltage switching circuit, and switching and outputting the output voltage in accordance with an external voltage applying signal,

wherein the second input is connected to the output of the external voltage applying circuit.

20. A voltage generating circuit having a negatively boosting

circuit for generating a voltage lower than the ground voltage by using a power source voltage, and a reference voltage generating circuit for generating a reference voltage, a desired voltage being generated on the basis of the reference voltage, comprising:

a voltage variation detecting circuit having a first input connected to the power source, a second input connected to the output of the negatively boosting circuit, and a third input connected to the ground, reference current equivalent to current occurring due to the potential difference between the first input and the second input being made to flow into the third input to generate a control voltage at a first output;

a differential amplifier circuit for comparing the control voltage and the reference voltage; and

a clamp circuit for extracting current from the output of the negatively boosting circuit in accordance with the output of the differential amplifier circuit to control the output voltage of the negatively boosting circuit.

21. The voltage generating circuit according to claim 20, wherein the clamp circuit comprises a second conduction type transistor having a source and a substrate that are connected to the output of the negatively boosting circuit, a gate connected to the output of the differential amplifier circuit and a drain connected to the power source or the ground, and the differential amplifier circuit is supplied with the power source voltage and

the output voltage of the negatively boosting circuit, compares the control voltage and the reference voltage with each other and carries out differential amplification on the basis of the power source voltage and the output voltage of the negatively boosting circuit.

22. The voltage generating circuit according to claim 20, wherein said clamp circuit comprises:

a second conduction type first transistor having a source and a substrate that are connected to the output of the negatively boosting circuit, and a gate and a drain that are connected to a first terminal;

a second conduction type second transistor having a source and a substrate that are connected to the output of the negatively boosting circuit; and

a first conduction type transistor connected between the power source and the first terminal and having a gate connected to the output of the differential amplifier circuit, and said differential amplifier circuit is supplied with the power source voltage and the ground voltage, compares the control voltage and the reference voltage with each other and carries out differential amplification on the basis of the power source voltage and the ground voltage.

23. A voltage generating circuit having a negatively boosting

circuit for generating a voltage lower than the ground voltage by using a power source voltage, and a reference voltage generating circuit for generating a reference voltage, a desired voltage being generated on the basis of the reference voltage, comprising:

a level shift circuit for receiving an output voltage of the negatively boosting circuit, and outputting a level-shifted voltage;

a voltage variation detecting circuit having a first input connected to the power source, a second input connected to the output of the negatively boosting circuit, and a third input connected to the ground, reference current equivalent to current occurring due to the potential difference between the first input and the second input being made to flow into the third input to generate a control voltage at a first output; and

a differential amplifier circuit for comparing the control voltage and the reference voltage to control the level shift circuit, and outputting a desired negative voltage at the output of the level shift circuit.

24. A voltage generating circuit having a reference voltage generating circuit for generating a reference voltage and a voltage generating circuit for generating a desired voltage on the basis of the reference voltage, comprising:

a level shift circuit for receiving a ground voltage and outputting a level-shifted voltage;

a voltage variation detecting circuit having a first input connected to the power source, a second input connected to the output of the negatively boosting circuit, and a third input connected to the ground, reference current equivalent to current occurring due to the potential difference between the first input and the second input being made to flow into the third input to generate a control voltage at a first output; and

a differential amplifier circuit having means for comparing the control voltage and the reference voltage to control the level shift circuit so that a voltage dropped from a desired power source voltage is output from the output of the level shift circuit is output.

25. The voltage generating circuit according to claim 23, wherein the level shift circuit has a second conduction type transistor having a source and a substrate that are connected to the output of the negatively boosting circuit, a gate connected to the output of the differential amplifier circuit and a drain connected to the output of the level shift circuit, and the differential amplifier circuit is supplied with the power source voltage and the output voltage of the negatively boosting circuit, compares the control voltage and the reference voltage and carries out differential amplification on the basis of the power source voltage and the output voltage of the negatively boosting circuit.

26. The voltage generating circuit according to claim 23,



wherein the level shift circuit comprises

a second conduction type first transistor having a source and a substrate that are connected to the output of the negatively boosting circuit, and a gate and a drain that are connected to a first terminal,

a second conduction type second transistor having a source and a substrate that are connected to the output of the negatively boosting circuit, a gate connected to the first terminal and a drain connected to the output of the level shift circuit, and

a first conduction type transistor that is connected between the power source and the first terminal and has a gate connected to the output of the differential amplifier circuit,

wherein the differential amplifier circuit is supplied with the power source voltage and the ground voltage, compares the control voltage and reference voltage and carries out differential amplification on the basis of the power source voltage and the ground voltage.

27. The voltage generating circuit according to any one of claims 20 to 26, further comprising:

first switching means for receiving a set voltage switching signal and carrying to a switching operation between the power source voltage and the voltage of the second input and outputting the switched one; and

second switching means connected between two terminals

between the first input and the second input, and switching the potential difference between the first input and the second input in accordance with the output of the first switching means.

28. The voltage generating circuit according to any one of claims 20 to 27, further comprising:

a reference voltage switching circuit for any two voltages or three voltages of the power source voltage, the reference voltage and any reference voltage generated by the power source voltage on the basis of a reference voltage switching signal;

wherein the first input is connected to the output of the reference voltage switching circuit.

29. The voltage generating circuit according to any one of claims 20 to 27, further comprising:

an external voltage applying circuit having means for carrying out a switching operation between an external applied voltage and the power source voltage, the reference voltage or any reference voltage generated by the power source voltage,

wherein the first input is connected to the output of the external voltage applying circuit.

30. The voltage generating circuit according to claim 28, further comprising:

an external voltage applying circuit for receiving an

external applied voltage and the output voltage of the reference voltage switching circuit, carrying out a switching operation between the external applied voltage and the output voltage of the reference voltage switching circuit in accordance with an external voltage applying signal and outputting the switched one,

wherein the first input is connected to the output of the external voltage applying circuit.

31. The voltage generating circuit according to claim 28 or 29, wherein a voltage having the same voltage level as the reference voltage can be applied by a voltage follower circuit.

32. The voltage generating circuit according to any one of claims 1 to 4, 8, 9, 20, 21, and 24 to 27, wherein the voltage variation detecting circuit comprises:

a current mirror circuit having a first intermediate node connected between the first input and the second input, and the first output connected between the first input and the third input, reference current equivalent to current occurring due to the potential difference between the first input and the second input being made to flow from the first input to the first output by detecting the voltage at the first intermediate node;

resistance means connected between the first intermediate node and the second input; and

a control voltage generating circuit that is connected between the first output and the third input, and generates the control voltage at the first output by making the reference current flow therethrough.

33. The voltage generating circuit according to claim 5 or 10, wherein the voltage variation detecting circuit comprises:

a current mirror circuit having a first intermediate node connected between the first input and the second input, and the first output connected between the first input and the third input, reference current that is kept to have a fixed current ratio to current occurring due to the potential difference between the first input and the second input being made to flow from the first input to the first output by the voltage applied to the fourth input;

resistance means connected between the first intermediate node and the second input; and

a control voltage generating circuit that is connected between the first output and the third input and generates the control voltage at the first output by making the reference current flow therethrough.

34. The voltage generating circuit according to claim 32 or 33, wherein the resistance means has plural resistors that are connected to one another in series between the first intermediate

node and the second input.

35. The voltage generating circuit according to claim 32 or 33, wherein the resistance means has plural first conduction type tenth transistors that are connected to one another in series between the first intermediate node and the second input so that a gate and a drain are connected to each other and a substrate and a source are connected to each other.

36. The voltage generating circuit according to claim 32 or 33, wherein the control voltage generating circuit has plural resistors that are connected to one another in series between the first output and the third input.

37. The voltage generating circuit according to claim 32 or 33, wherein the control voltage generating circuit has one or more first conduction type tenth transistors that are connected to one another in series between the first output and the third input so that a gate and a drain are connected to each other and a source and a substrate are connected to each other.

38. The voltage generating circuit according to claim 32, wherein the current mirror circuit comprises:

a first conduction type eleventh transistor having a source connected to the first input, and a gate and a drain

connected to the first intermediate node; and

a first conduction type twelfth transistor having a source connected to the first input, a gate connected to the first intermediate node and a drain connected to the first output.

39. The voltage generating circuit according to claim 32, wherein the current mirror comprises:

plural resistors connected to one another in series between the first input and the first intermediate node; and

a first conduction type thirteenth transistor having a source connected to the first input, a gate connected to the first intermediate node and a drain connected to the first output.

40. the voltage generating circuit according to claim 32, wherein the current mirror circuit comprises:

a first conduction type eleventh transistor having a source connected to the first input, and a gate and a drain that are connected to the first intermediate node;

a first conduction type twelfth transistor having a source connected to the first input, a gate connected to the first intermediate node and a drain connected to the second intermediate node; and

a first conduction type thirteenth transistor having a source connected to the second intermediate node, a gate connected to any terminal of the resistance means, and a drain connected

to the first output.

41. The voltage generating circuit according to claim 32, wherein the current mirror circuit comprises:

plural resistors that are connected to one another in series between the first input and the first intermediate node;

a first conduction type twelfth transistor having a source connected to the first input, a gate connected to the intermediate node and a drain connected to the second intermediate node; and

a first conduction type thirteenth transistor having a source connected to the second intermediate node, a gate connected to any terminal of the resistance means and a drain connected to the first output.

42. The voltage generating circuit according to claim 33, wherein the current mirror circuit comprises:

a first conduction type eleventh transistor having a source connected to the first input, and a gate and a drain that are connected to the first intermediate node;

a first conduction type twelfth transistor having a source connected to the first input, a gate connected to the first intermediate node and a drain connected to the second intermediate node; and

a first conduction type thirteenth transistor having a source connected to the second intermediate node, a gate connected

to the fourth input and a drain connected to the first output.

43. The voltage generating circuit according to claim 33, wherein the current mirror circuit comprises:

plural resistors connected to one another in series between the first input and the first intermediate node;

a first conduction type twelfth transistor having a source connected to the first input, a gate connected to the first intermediate node and a drain connected to the second intermediate node; and

a first conduction type thirteenth transistor having a source connected to the second intermediate node, a gate connected to the fourth input and a drain connected to the first output.

44. A voltage generating circuit having a boosting circuit for generating a voltage higher than a power source voltage, a negatively boosting circuit for generating a voltage lower than the ground voltage by using the power source voltage, and a reference voltage generating circuit for generating a reference voltage, a desired voltage being generated on the basis of the reference voltage, comprising:

a first external voltage applying circuit having means for carrying out a switching operation between an external applied voltage and the power source voltage in accordance with a first external voltage applying signal;



a first voltage variation detecting circuit that has an eleventh input connected to the output of the boosting circuit, a twelfth input connected to the output of the first external voltage applying circuit, and a thirteenth input connected to the ground, and generates a first control voltage at a first output;

a first differential amplifying circuit for comparing the first control voltage and the reference voltage;

a first clamp circuit for controlling the output voltage of the boosting circuit in accordance with the output of the first differential amplifying circuit;

a second external voltage applying circuit having means for carrying out a switching operation between the external applied voltage and the power source voltage in accordance with a second external voltage applied signal;

a third voltage variation detecting circuit that has a thirty first input connected to the power source, a thirty second input connected to the output of the negatively boosting circuit and a thirty third input connected to the ground, and generates a third control voltage at a third output;

a third differential amplifier circuit for comparing the third control voltage and the reference voltage; and

a second clamp for controlling the output voltage of the negatively boosting circuit in accordance with the output of the third differential amplifier circuit.

45. A voltage generating circuit having a boosting circuit for generating a voltage higher than a power source voltage, a negatively boosting circuit for generating a voltage lower than the ground voltage by using the power source voltage, and a reference voltage generating circuit for generating a reference voltage, a desired voltage being generated on the basis of the reference voltage, comprising:

a first external voltage applying circuit having means for carrying out a switching operation between an external applied voltage and the power source voltage in accordance with a first external voltage applying signal;

a first voltage variation detecting circuit that has an eleventh input connected to the output of the boosting circuit, a twelfth input connected to the output of the first external voltage applying circuit, and a thirteenth input connected to the ground, and generates a first control voltage at a first output;

a first differential amplifying circuit for comparing the first control voltage and the reference voltage;

a first clamp circuit for controlling the output voltage of the boosting circuit in accordance with the output of the first differential amplifying circuit;

a first level shift circuit for receiving the output voltage of the boosting circuit and outputting a level-shifted voltage;

a second voltage variation detecting circuit that has a twenty first input connected to the output of the first level shift circuit, a twenty second input connected to the power source and a twenty third input connected to the ground, and generates a second control voltage at a second output;

a second differential amplifier circuit having means for comparing the second control voltage and the reference voltage with each other and control the first level shift circuit so that a desired voltage is output from the output of the first level shift circuit;

a second external voltage applying circuit having means for carrying out a switching operation between the external applied voltage and the power source voltage in accordance with a second external voltage applying signal;

a third voltage variation detecting circuit that has a thirty first input connected to the power source, a thirty second input connected to the output of the negatively boosting circuit and a thirty third input connected to the ground, and generates a third control voltage at a third output;

a third differential amplifier circuit for comparing the third control voltage and the reference voltage;

a second clamp for controlling the output voltage of the negatively boosting circuit in accordance with the output of the third differential amplifier circuit;

a second level shift circuit for receiving the output

voltage of the negatively boosting circuit and outputting a level-shifted voltage;

a fourth voltage variation detecting circuit that has a forty first input connected to the power source, a forty second input connected to the output of the second level shift circuit and a forty third input connected to the ground and generates a fourth control voltage at a fourth output; and

a fourth differential amplifier circuit having means for comparing the fourth control voltage and the reference voltage with each other and controlling the second level shift circuit so that a desired negative voltage is output from the output of the second level shift circuit.

46. The voltage generating circuit according to claim 44 or 45, wherein the reference voltage generating circuit has a reference voltage generating unit for generating a reference voltage, and a trimming circuit unit for receiving a trimming signal and changing the voltage level of the reference voltage to generate a reference voltage.

47. The voltage generating circuit according to claim 44 or 45, wherein the reference voltage generating circuit has a reference voltage generating unit for generating a reference voltage and a trimming circuit unit having means for receiving a trimming signal and changing the voltage level of the reference

voltage to generate a reference voltage, and said voltage generating circuit further comprises:

a third level shift circuit for receiving the ground voltage and outputting a level-shifted voltage;

a fifth voltage variation detecting circuit that has a fifty first input connected to the power source, a fifty second input connected to the output of the third level shift circuit, and a fifty third input connected to the ground and generates a fifth control voltage at a fifth output; and

a fifth differential amplifier circuit for comparing the fifth control voltage and the reference voltage and controlling the third level shift circuit so that a voltage dropped from the power source voltage between the power source voltage and the ground voltage is output from the output of the third level shift.